AEROSOL SOLVENT WELD CEMENT, DISPENSING SYSTEM AND METHOD OF JOINING PLASTIC PIPE

las a1

Field of the Invention

The present invention is directed to a solvent weld cement (SWC) and method for applying same, and more particularly to an aerosol solvent weld cement dispensing system and a method of joining plastic pipe.

Background of the Invention

Plastic pipe has become increasingly used in a wide variety of applications, such as in water transmission networks, residential plumbing, and even in the construction of a wide variety of structures bearing no relation to water transmission. Plastic pipe continues to replace ceramic and metal pipe in a variety of applications owing to its reduced weight, lower cost, and resistance to cracking under stress.

Plastic pipe, such as PVC pipe, has the advantage of being capable of forming watertight junctions through the use of SWCs, instead of having to rely on the interference fittings used in conjunction with ceramic pipes, or on the welded joints found with metal pipe. An advantage associated with the use of a SWC is that it allows the plastic pipe to be joined by relatively unskilled workers, as compared to the level of skill necessary in connection with the welding or soldering of metal pipes.

Thus for example, in the laying of plastic water pipe, it is (well-known) that the pipe sections can be joined through the use of liquid SWCs. It should be understood that all references to "plastic pipe" are meant to include not only pipe, but plastic

components used in the laying of pipe such as elbows and various connectors. In such an operation, first a cleaner, such as tetrahydrofuran or methyl ethyl ketone, is applied to the ends of the respective plastic pipe components to be joined. Next, a primer which comprises a (dye) is often applied to verify that cleaning has occurred. Finally, the SWC is applied by brushing the liquid SWC over the ends of the respective plastic pipe components to be joined.

However, within the confines of a 7 to 10 foot (2 to 3 meter) deep trench box, where actual installation takes place, the conditions are far from ideal. For example, the conditions are somewhat cramped. Moreover, in such applications, the pipe installer has no convenient location where an open SWC container can be placed. Thus, the SWC container typically is placed alongside the top of the trench. Since the SWC container may be knocked or kicked over, there is risk of a resultant loss of SWC, contamination of the soil with hazardous substances, and attendant loss of time and productivity. The same can be said if the container is kept within the trench box and it overturns. Additionally, the SWC may be contaminated, typically by dirt, debris or water at the work site, which can adversely affect the efficiency of the SWC.

There are additional problems associated with the use of existing solvent weld cements (SWC), which cements are liquids stored in jars or containers, with the liquid typically being applied to the plastic pipes to be joined together by use of a

brush. First, such mode of application is normally messy, given the aforementioned cramped confines. Further, the spatial limitations often do not result in the application having the desired uniformity. Thus, not only do liquid SWCs often not provide an even coating of an effective amount of SWC, they often cause waste and attendant mess through liquid run-off.

Yet another drawback associated with existing SWCs is that they typically do not allow the installer enough time to properly align the adjacent plastic pipes, because the cement sets up in only a few seconds and produces a weld that cannot be altered. Accordingly, it is desirable to be able to apply SWC to plastic pipe in such a way that set-up time is extended to better allow the installer enough time to properly align the plastic pipe pieces, and be assured that the joint is properly completed.

Examples of liquid SWCs are disclosed in Meyers, U.S. Pat. No. 5,336,351 and King, U.S. Pat. No. 4,687,798 and the patents discussed therein. As can be appreciated from a review of those references, attempts at solving the long-felt problem associated with existing SWCs have apparently focused on inventing improved liquid SWC compositions.

It is thus apparent that the need exists for improvements in the known dispensing systems and methods associated with the solvent welding of plastic pipe. Such improvements would be well received by contractors and workers alike, and would represent an important advancement to the construction industries.

Summary of the Invention

There is disclosed an aerosol SWC composition for welding plastic pipe, and a method for using same. In general, the aerosol SWC composition of the present invention comprises: (a) at least one resin adapted to bond to the plstic pipe; (b) at least one solvent; and (c) at least one ropellant, wherein the composition is stored under a presse greater than ambient atmospheric pressure. A dye could alsce provided, as could a suspending agent, and an appropriate stilizer.

The present invention also includes a metl of dispensing an aerosol SWC composition using an aerosol coiner, as described herein. In broadest terms, the methcomprises the steps of (a) obtaining a pressurized aerosol Composition of the present invention in a dispensing containehe composition being under a pressure greater than ambient atheric pressure; and (b) opening the valve of the container so o cause the pressurized aerosol SWC composition to be rele from said container. The valve preferably is sealed to can y an elastomeric gasket.

The present invention also includes a metof ding two sections of plastic pipe at a junction by use n aosol SWC composition, said method comprising: (a) obtai a essurized aerosol SWC composition in accordance with thesenvention in a dispensing container, said composition beina pressure greater than ambient atmospheric pres composition being disposed in a container adaptain said

pressurized aerosol SWC composition, said container comprising an outlet and a valve to control the release of said pressurized aerosol SWC from said container; and (b) opening the valve so as to cause said pressurized aerosol SWC composition to be released from said container onto one or both of the two sections of plastic pipe at the prospective location of the junction; and (c) adjoining the two sections of plastic pipe so as to form the junction by welding action. The valve preferably is sealed to the can by an elastomeric gasket.

The present invention also includes a system for enabling an installer to join two sections of plastic pipe at a junction, which comprises: (a) a pressurized aerosol SWC composition in a dispensing container, as described above; and (b) a holster adapted to be worn by an installer, said holster capable of carrying said dispensing container and adapted so that the dispensing container can be removed by the installer for use and placed back into the holster.

The invention, accordingly, comprises the composition, container, system and method possessing the construction, combination of elements, and arrangement of parts and steps which are exemplified in the following detailed description. Reference to that description and to the accompanying drawings should be used for a fuller understanding and appreciation of the nature and objects of the invention, although other objects may be obvious to those skilled in the art.

The primary objective of this invention is to provide a neat and reliable SWC that can provide uniform application to the desired surface, and which resists contamination and oxidation.

Another objective of the present invention is to provide a method of applying SWC in the joining of plastic pipe that allows the installer to quickly apply an effective amount of the SWC, yet be afforded enough set up time to properly align and complete the joint between two plastic pipe pieces.

Yet another objective of the present invention is to provide a method of applying SWC in the joining of plastic pipe, which method simultaneously permits a dye to be sprayed onto the plastic along with the resin to be chemically bonded through welding, so as to verify to observers that a SWC has been applied.

Still another objective of the present invention is to provide a method of applying SWC in the joining of plastic pipe that allows the installer to apply SWC to the plastic pipe using only one hand, instead of the two hand method associated with the existing use of a can and brush dispenser.

Other aspects and advantages of the instant invention will be appreciated from the following description, drawings, and the appended claims.

Brief Description of the Drawings

Figure 1 is a perspective view of a trench wherein an installer is laying water pipe by joining pipe sections wherein

provision is made to use the inventive SWC composition, method, and system, in accordance with one embodiment of the present invention.

Figure 2 is an elevational perspective view of the novel aerosol SWC container disposed in the holster, in accordance with one embodiment of the present invention.

Figure 3 is cross-section of an aerosol container in accordance with one embodiment of the present invention.

Detailed Description of the Invention

In accordance with the foregoing summary, the following presents a detailed description of the invention. Having reference to the drawings, attention is directed first to Figure 1 which discloses a trench, designated generally by the numeral 10 dug in a field, in which plastic water pipe is to be laid. Trench 10 typically is dug into the ground some 7 to 10 feet below elevation and in length suitable for the terrain and length of plastic pipe sections being joined. In Figure 1, installer 12 is joining plastic pipe sections 14 and 16. It will be observed that section 16 is adjacent bell end 20. Spigot 22 of pipe section 14 is adapted in circumference to fit inside bell 18 in dimensional tolerance such that the resulting seal is watertight after welding.

In order to ensure that spigot 22 will readily mate with bell 20, a SWC is applied. Heretofore, as described above, installer 12 would employ liquid SWC on the plastic pipe with a

brush, rag, or the like, dispensed from an open container which must be held by the installer during application of the SWC, and then set some place thereafter. Often, this open container is set at the mouth or edge of trench 10 where it is in danger of being knocked over or contaminated.

Rather than painting the liquid SWC on the plastic pipe with a brush, rag, or the like, the present invention relies on a system that includes an aerosol SWC and optional holster arrangement. Specifically, Figure 2 depicts an aerosol container carried by holster 26. Holster 26 conveniently can be made from leather, nylon fabric, or similar durable material and is adapted with clip 28 which enables holster 26 to be clipped onto a belt 30 or onto the top of pants 321 of the installer 12. As can be appreciated from a comparison of Figures 1, 2, and 3, installer 12 can withdraw container 24 from holster 26 for the depressing of actuating valve 34, thus releasing aerosolized SWC from within container 24 to weld spigot 22 and/or bell 20. Once the aerosol SWC has been applied, installer 12 can readily replace container 24 into holster 26 and proceed with the plastic water pipe installation. Although not shown, the actuating valve preferably is sealed to the container by an elastomeric gasket.

Referring to container 24, housed therewithin is an aerosol SWC composition in accordance with the present invention, as described herein. Container 24 sprays from all angles, typically empties completely, and functions at temperatures below 20°F. While a container fitted with a valve for dispensing pressurized

contents from within container 24 has been described, it will be appreciated that any conventional system for dispensing pressurized material from within a container may be employed in accordance with the precepts of the present invention. A conventional aerosol can with valve has been used to illustrate the present invention as such units are ubiquitous commercial products that enable cost effective and efficient packaging and dispensing of the aerosol SWC system disclosed herein. A conventional aerosol can includes an actuating valve preferably sealed to the container by an elastomeric gasket. It should also be noted that other equivalent dispensing systems may be conceived of by the skilled artisan and are included within the precepts of the present invention.

Figure 3 shows a cross-section elevational view of an aerosol can in accordance with one embodiment of the present invention. Figure 3 shows aerosol container 24 and actuating valve 34. Aerosol container 24 contains the aerosol SWC composition 36 under pressure that allows it to issue as a spray 38 from the actuating valve when activated. The pressure is greater than the ambient atmospheric pressure. More prefereably the pressure is greater than 40 pounds per square inch. Most preferably, the pressure is 62 pounds per square inch. The actuating valve 34 may have a standard or tapered orifice, although a wide open actuator is preferred. A conventional aerosol container includes an actuating valve preferably sealed

to the container by an elastomeric gasket. Aerosol container 24 may also have a liner 40 on its interior surface.

The aerosol solvent weld cement composition associated with this invention comprises at least one resin adapted to bond to plastic pipe, at least one solvent, and at least one propellant. A dye could also be provided, and it is also desirable to include a stabilizer for stabilizing the resin, especially where the resin is CPVC, and a suspending agent. The aerosol SWC composition of the present invention may be formulated and packaged in accordance with methods and steps known in the art.

The resin associated with the invention may be any resin or combination appropriate for welding the plastic of the pipe selected, and may be selected from the group consisting of chloropolyvinylchloride (also known as a chlorinated polyvinyl chloride or CPVC) resins, polyvinyl chloride (PVC) resins, acrylonitrile-butadiene-styrene (ABS) resins, butyrate resins, and acrylic resins. Butyrate resins, also known as butanoic acid ester resins, are formed as a derivative of butyric acid. It is preferred that the resin content of the aerosol SWC composition be in the range of about 10% - 30% by weight of the total aerosol SWC composition. For welding PVC pipe, it is preferred that the resin actually be a chloropolyvinylchloride resin, and that it be present in an amount of about 10% by weight of the aerosol SWC composition.

The use of CVPC as the preferred resin requires the use of a stabilizer in the solvent system of the invention to prevent the

degradation of the CPVC. This degradation has two unfortunate consequences. First, it encourages the pre-polymerization of the resin, such that it jells. Secondly, as it degrades it becomes more aggressive, such that it can corrode the interior of the container thereby contaminating the SWC. A stabilizer must be selected which can preclude the degradation of the CPVC. This can be done by one of ordinary skill in the art, depending on the specifics of the solvent system.

The solvent may be any appropriate solvent used in conjunction with the selected resin, including those selected from the group consisting of tetrahydrofuran (THF), acetone, diethoxyethane, N-methyl pyrrolidone (NMP), dibasicesters, alkylene carbonates, dimethylformamide, ethyl acetate, methyl isobutyl ketone (MIBK), methyl alcohol, cyclohexanone, methyl ethyl ketone (MEK), gamma-butyrolactone (also known as butyrolactone or GBL), and mixtures thereof. In what is believed to be the preferred embodiment of the invention, the solvent(s) will be present in a blend which includes tetrahydrofuran, cyclohexanone, acetone, and gamma-butyrolactone. For welding PVC pipe, it is preferred that the solvent be a mixture of about 30-50% by weight tetrahydrofuran, about 20-40% by weight acetone, about 10-20% by weight cyclohexanone, and about 5-15% by weight gamma-butyrolactone. More preferably the solvent blend is of about 40% by weight tetrahydrofuran, about 30% by weight acetone, about 15% by weight cyclohexanone, and about 10% by weight gamma-butyrolactone.

The aerosol SWC composition also may contain a suspending agent, which suspending agent may be any of those known in the art, however, in the preferred embodiment of the invention amorphous silica is used in an amount of about 1-5% by weight. The inclusion of a suspending agent helps with the product's viscosity. The aerosol thus may be homogeneous or heterogeneous. (The aerosol SWC composition may also include a dye for purposes of providing visibility to the SWC when it is applied to pipe. The cosmetic dye chosen should be oil soluble, and enough should be used to impart a color to the SWC when sprayed onto the pipe. For example, a purple dye could be used, since many existing liquid SWCs appear milky.) new

The propellant may be any appropriate propellant used in conjunction with the selected resin, and may be dimethyl ether, or a blend of dimethyl ether along with another propellant selected from the group consisting of isobutane, butane, propane, nitrogen, carbon dioxide, 1-difluoroethane, tetrafluoroethane and mixtures of any two or more of said propellants. For welding PVC pipe, it is preferred that the propellant be dimethyl ether, and that the dimethyl ether be present in an amount of between about 20% by weight to about 50% by weight of the aerosol SWC composition, and most preferably about 30% by weight of the aerosol SWC composition.

The following represents the preferred range associated with the formulation of this invention for use with plastic pipe, with this formulation having been found to work with more than one pipe type:

Aerosol SWC

CPVC Resin	2-30%
Amorphous Silica	1-5%
Tetrahydrofuran	0-50%
Acetone	0-40%
Cyclohexanone	0-25%
Butyrolactone	0-20%
Oil soluble dye	q.s.
Stabilizer	q.s.

The preferred propellant for the above formulation is dimethyl ether present in the range of from about 20% to about 50%, and more preferably 30%. It should be recognized that the presence of a stabilizer in the foregoing formulation can be attributed to the presence of the CPVC resin, and that a stabilizer may not be necessary in other formulations made in accordance with this invention that do not use CPVC as a resin choice. Similarly, it should be recognized that while the presence of a dye is not chemically necessary in order to practice the invention, it has to do with an aesthetic or marketing aspect of the invention.

The present invention also includes an aerosol SWC composition in a container for welding plastic pipe, which composition is described herein. The container is adapted to contain the pressurized aerosol SWC composition, and the container comprises an outlet and a valve to control the release of the pressurized aerosol SWC composition from the container.

The container preferably comprises a 360° valve and an unrestricted actuator. A conventional aerosol container includes an actuating valve preferably sealed to the container by an elastomeric gasket. The container may be of any size and may be selected from any type adapted to contain the aerosol SWC composition under pressure. Such containers may include aerosol canisters of the type known in the art, but not limited to, such as those made of tin-plated, unlined tin plated steel or aluminum.

The aerosol SWC composition and the method of use may be applied to weld a variety of plastic pipe in a wide array of applications. For instance, the present invention can be applied in interior and exterior plumbing (both commercial and residential), in water supply, communication pipe, drainage, waste ventilation and underground water and waste water systems, as well as for irrigation or any other water conduit.

In actual use, the aerosol SWC composition of this invention is sprayed onto the sections of plastic pipe to be welded together. One spraying deposits on the plastic pipe not only the resin which is chemically bonded to the plastic pipe by means of the solvent system associated with the invention, but also in one embodiment of the invention a dye which verifies that a SWC has been applied. Thus, one spraying of the plastic pipe accomplishes what heretofore required two or three separate applications of liquids using brushes, rags or the like.

Advantages of the present invention include the convenience of using a closed container in a field trench or other areas that are dirty and wet, which method of use minimizes spillage and contamination of the SWC. Another advantage is the convenience of spraying the SWC onto the plastic pipe surfaces to be joined. The aerosol spray container generally is less cumbersome and is lighter than the can and brush dispensers of the prior art. A further advantage is the ability to be able to hold the container at any angle and still have the SWC spray from the container.

Still another advantage is that it has been found that the sprayed aerosol SWC composition associated with this invention provides longer set up times for the installer. In this regard, it has been found that the freshly sprayed SWC of the invention sets up in about 8 to 12 seconds in comparison to the 3 to 5 second set up time typically experienced in brushed liquid applications. It is believed that the propellant evaporating from the freshly sprayed aerosol SWC lowers the temperature on the surfaces to be bonded thereby extending the working time. The sprayed SWC also provides an even coating of an effective amount of SWC, eliminating much of the waste and mess associated with liquid applications.

Yet another advantage is a holster which carries the container and from, and into which, the container can be placed by the installer while in the trench. Thus, the container is always with the installer, yet the container does not impede the installer's ability to work. Yet another advantage is the

ability to readily weld plastic pipes in a trench in the field, by being able to quickly apply an effective amount of an SWC to the desired joint area. The efficacy of the SWC of the present invention may be ascertained using ASTM method number D 740-94.

While the foregoing description has been made with reference to plastic water pipe, it will be appreciated that the present invention may be used with a variety of other plastic pipe known in the art. For example, plastic residential and commercial plumbing and sewer pipe, drain pipe, process piping used in factories and other manufacturing facilities, and the like. Thus, the present invention should not be construed in a limiting sense with respect to the particular piping involved. So long as plastic pipe requiring attachment by welding action is at hand, the present invention has applicability with particular advantage in welding plastic pipe, particularly in outdoor applications, where spillage and contamination are problematic.

While the form of apparatus and method herein described constitute a preferred embodiment of this invention, it is to be understood that the invention is not limited to this precise form of apparatus and method and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is: